Effects of Aromatherapy in Patients with Leukemia: Impact of Gender, Age, and Scent Preference

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Abstract

Patients newly diagnosed with acute leukemia experience an array of different symptoms throughout their chemotherapy treatments in the hospital. Aromatherapy, the use of essential oils through diffusion, is often used to alleviate some of these symptoms. The purpose of this study was to: (1) to examine the difference in response to aromatherapy in patients with acute leukemia by gender on sleep quality and other common symptoms associated with cancer; (2) to examine the difference in response to aromatherapy in patients with acute leukemia by age on sleep quality and other common symptoms associated with cancer; (3) to determine if there is a difference in response to aromatherapy among patients with leukemia by scent selection. This randomized, cross-over, wash out trial included fifty acute leukemia patients in the hospital for their initial chemotherapy treatments. These patients were all at least eighteen years of age and were offered a choice between three different scents of aromatherapy: lavender, peppermint, or chamomile. Patients were randomized to receive either aromatherapy or placebo during week one. During the second week (washout period), nothing was diffused, and during the third week the opposite intervention was given. Major outcome variables include sleep quality measured by the Pittsburgh Sleep Quality Index and other common cancer side effect symptoms measured by the Edmonton Symptoms Assessment Scale. Patients completed a Final Evaluation of Aromatherapy to evaluate their experience with the aromatherapy. Our results showed us that aromatherapy as a whole had a positive impact on patient experience and managed symptoms well. There was no statistically significant difference between males and females or by age. The lavender scent was most commonly chosen. Overall, aromatherapy has decreased the common symptoms associated with

chemotherapy such as insomnia, pain, and anxiety and has increased the patients' overall wellbeing.

Chapter 1

Introduction

The term "aromatherapy" refers to the use of essential oils that come from plants with the intent to calm, relax, and strengthen a person's spirit (Louis, 2002). The use of aromatherapy has been around for many years, however it is just recently becoming more popular among nurses and other healthcare providers The purpose of the primary study was to determine if aromatherapy improved insomnia and other common symptoms in newly diagnosed hospitalized leukemia patients, including pain, nausea, lack of appetite, shortness of breath, depression, anxiety and wellbeing and if patients perceive aromatherapy as a positive experience for symptom management. This study was a secondary analysis. The aims of this study were to: 1) to examine the difference in response to aromatherapy in patients with acute leukemia by gender on sleep quality and other common symptoms associated with cancer; (2) to examine the difference in response to aromatherapy in patients with acute leukemia by age on sleep quality and other common symptoms associated with cancer; (3) to determine if there is a difference in response to aromatherapy among patients with leukemia by scent selection.

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Chapter II

Review of Literature

Signs and Symptoms of Leukemia

Leukemia is a progressive form of cancer in which a person's bone marrow produces increased numbers of immature or abnormal leukocytes (Danyi, 2016). This disease can take many forms and presents in a variety of different clinical signs and symptoms. Some of these underlying issues at the cellular level include, but are not limited to, low levels of hemoglobin, a low platelet count, a low neutrophil count, poor effects of non-steroidal anti-inflammatory drug therapy, enlarged spleen, and increased levels of monocytes (Danyi, 2016).

While those changes are occurring within the body, many changes outside the body are beginning to develop as well as a result. The low hemoglobin could lead to signs and symptoms of anemia, while the low platelet count causes the patient to become extremely immunosuppressed. While in an immunocompromised status, the patient is more susceptible to infection and other disease processes that intensify the existing problems. Because of this, the treatment for this type of cancer typically includes chemotherapy.

Signs and Symptoms of Chemotherapy

Chemotherapy is the most common form of cancer treatment that uses drugs to destroy the numerous and multiplying cancer cells. Many people are intimidated by the idea of chemotherapy because of the devastating symptoms associated with it such as hair loss, nausea and vomiting, and constipation or diarrhea. Chemotherapy targets a certain type of cell that also exists in areas around the mouth or hair, thus leading to hair loss.

Because these symptoms can be treated by other medications and due to the previous successes in the past, chemotherapy is the most widely used and most successful form of treatment for treating most types of cancers. There have been various studies on the effects of aromatherapy on managing symptoms related to chemotherapy. Some have proven beneficial to managing symptoms well, while others conclude that there is not substantial evidence to say one way or the other (Lua).

Aromatherapy In Other Patient Groups

Aromatherapy is widely used among many people for a variety of reasons, and one of the biggest and most common reasons for the use of aromatherapy is to treat insomnia. Insomnia is defined as the subjective dissatisfaction with the duration or quality of sleep (Lewith, 2005). While getting enough sleep is important for a person's health and well being, a lack of sleep can actually cause fatigue, drowsiness, nervousness, dizziness, instability, disorientation, and attention disorders (Hwang, 2015). Because aromatherapy is one of the most rapidly growing areas of complementary medicine, victims of insomnia are typically most interested in trying this method as a way to cure their sleep disorder. Different studies have reviewed the effects of aromatherapy and determined that it has decreased many of the patients' psychological factors, including depression, anxiety, and stress, while also having a positive effect on factors such as sleep and relieving pain (Hwang, 2015).

Aromatherapy is also widely used with the hospice and end of life population. One of the most important goals in palliative care is achieving a good death or a good dying process in the last stages of life (Nakano, 2013). Unfortunately, many of these patients in hospice are in need of additional interventions that promote this sense of

comfort. Because of the lower price, lack of negative side effects, and ease of administration, aromatherapy is one of the most widely chosen supplements (Louis, 2002). One of the biggest problems with patients in hospice is the feeling of depression. When an individual suffers from depression, the symptoms include loss of interest, loss of energy, weight gain, insomnia, depressed mood, difficulties in thinking and concentrating, and recurrent thoughts of death (Yim, 2009). Again, because of the symptoms that these people present with, aromatherapy seems to be the front-runner in adjunctive medicine.

Current Research in Aromatherapy

Aromatherapy is a type of therapy in which the outcome is difficult to interpret. It typically includes evaluations of subjective data by judging how a patient is physically and mentally feeling after the treatment is completed. Because of this, aromatherapy is still in its infancy and requires much more research to be performed on its behalf. However, even though much more information is needed on this subject as a whole, we have been able to get a good understanding as to how aromatherapy works and what the typical outcomes should look like.

Two of the most commonly researched methods of using aromatherapy include massages and aromasticks. The main aim of using aromatherapy massage in cancer care is to improve patients' quality of life and reduce psychological distress (Fellowes, 2004). Some studies have shown that cortisol levels have decreased after aromatherapy and massage and may have had a positive impact on patients dealing with a life-threatening illness (Stringer, J., Swindell, R., 2008). The literature states that when the participants listed some of the benefits they experienced after going through a treatment of

aromatherapy massage, they included feelings of relaxation, increased energy levels, better sleeping patterns, and a reduction in tension (Dunwoody, 2002). These can all lead to a person gaining their strength back and easing some of their discomfort during this time.

An aromastick is defined as "an individual plastic inhaler device containing an inner wick which is blank permitting the addition of essential oils" (Dyer, 2014). This is an example of another popular way that aromatherapy is administered to patients. The scent of the aromasticks can play a very important role in the outcomes of these patients' treatment. The odor from the oils can actually stimulate memory or emotion in the brain and have some physical effects as well (Stringer, J., Donald, G., 2011). This is becoming a more commonly used device because of the ease of carrying around a portable device along with the positive effects that patients have reported with this treatment.

Conclusion

Despite the lack of research on aromatherapy there is still enough research presented to be able make an overall conclusion about this intervention: it has improved the quality of life and relieved symptoms of patients with cancer, while not causing any negative outcomes. This is a very important discovery in the medical field because of the high prevalence of cancer in today's society. While most literature to this day talks about the effects of aromatherapy as a whole, little is known about the effects on leukemia patients specifically. This study is meant to address this gap and determine the outcomes of using this form of treatment. Patients with cancer almost always go through the chemotherapy process and struggle through its many side effects and consequences. Aromatherapy has been shown to work for these patients a countless number of times and

therefore will most likely continue to be used and researched for many more years to come.

Chapter III

Methods

Design

A secondary analysis of a randomized, cross-over, wash out trial, with the experimental group acting as its own control. This was a three-week trial with participants randomly assigned to either the placebo or aromatherapy treatment during the first week. The second week consists of a washout period, followed by either the placebo or the aromatherapy during the third week. Patients were chosen randomly using a computer-generated table of random numbers.

Setting

This study took place on the acute leukemia unit at the James Cancer Hospital at the Ohio State University Wexner Medical Center. The James Cancer Hospital has received high rankings from the National Cancer Institute and is consistently voted as one of the top cancer hospitals in the nation. With 962 beds, it is the largest cancer hospital in the Midwest and third largest in the country.

Sample

This study included fifty patients of eighteen years or older that were hospitalized on an acute leukemia unit. Inclusion criteria included that these patients were newly diagnosed and hospitalized to receive four weeks of intensive induction chemotherapy. Exclusion criteria included a history of asthma, sleep apnea, a planned less than three week hospitalization, patients who had not completed their initial steroids, patients who were confused and unable to give informed consent, non-English speaking patients, and patients with previous experience with aromatherapy.

Instrument

The Pittsburgh Sleep Quality Index (PSQI) is a questionnaire that assesses sleep quality and any disturbances over a certain time frame. The "component" scores in this study include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of these scores for these components results in one overall score. The overall score ranges from 0 (best sleep) to 21 (worst sleep). PSQI has six subscales. Subjects are asked to rank each subscale by using a Likert scale, which ranges from 0-3. These subscales include Duration of Sleep, Sleep Latency (the time it takes a person to fall asleep), Day Dysfunction Due To Sleepiness, Sleep Efficiency (the ratio of time spent in bed to time spent being asleep), Overall Sleep Quality, and Needs Medications to Sleep. The scale ranges from 0 (best sleep) to 21 (worst sleep). A score of 3 would be the highest and worst sleep among each individual subcategory. A total overall score of >5 indicates the person has poor sleep quality. A study on the reliability and validity of the PSQI concluded that this index has high test-retest reliability for patients with primary insomnia. The seven component scores of the PSQI had an overall reliability coefficient of 0.83, indicating a high degree of internal consistency. The correlation of PSQI data with sleep logs during the study demonstrates good validity of the PSQI. The article reminds us to keep in mind that the PSQI score alone does not allow for differentiation of the different sleep disorders due to psychiatric disorders, so the validity of some of the questions should be evaluated further. Overall, research has concluded that the PSQI proved valuable to clinical work on insomnia and is a useful first-line and easy-to-handle questionnaire to evaluate sleep disturbance (Backhaus,

2002). This index will be completed before the experiment begins to gather a baseline for insomnia. It will then be given at the end of week 1 (Day 8) in the morning, at the end of week 2 (Day 15) in the morning, and at the end of week 3 (Day 22) in the morning.

The Edmonton Symptom Assessment Scale (ESASr) is an 11-point numerical rating scale for self-report of nine common symptoms of cancer. The ESASr uses a visual analogue scale with a range of 0-10, with the number 0 indicating an absence of the symptom and the number 10 being the worst possible symptom. A recent study on the reliability and validity of the ESASr has concluded that this newer version of the original ESAS has been vastly improved and more easily understood among patients. While more research needs to be conducted, the findings of this study support the use of the ESASr for use in symptom screening (Watanabe, 2012). This scale will be first completed prior to the experiment to gather a baseline. It will then be completed every morning by the patient throughout the remainder of the experiment.

The Final Evaluation of Aromatherapy (FEA) had the patient rate their general experience with aromatherapy on a scale from 1-10, with 1 being terrible and 10 being exceptional. The tool also asked the patient for any positive or negative comments regarding the use of aromatherapy. This is an investigator-developed tool in which patients rate their general experiences. It will also ask the patient which week, week one or three, they believe they received the aromatherapy. It was completed at the end of week 1 (Day 8) in the morning and at the end of week 3 (Day 22) in the morning.

Data Collection Procedures

After obtaining approval by the Cancer Scientific Research Committee and Institutional Review Board, the potential patients were screened by the leukemia clinical

nurse specialist and the multidisciplinary team for inclusion and exclusion criteria. The patients who met criteria were then approached for informed consent. Because of the importance of scents, the patients were given the choice between three different scents of essential oils: lavender, peppermint, or chamomile. Patients were first introduced to the smell by placing a drop of the oil on a cotton pad for them to smell. They were provided with coffee beans to smell in between scents. Rose water was used as the placebo, as it does not have a scent and is not an essential oil. A diffuser with either the essential oil or the placebo was placed in a predetermined, measured spot within the patient room to ensure the diffusion of the oils was consistent with each patient. Neither the patient nor the researchers were aware if the oils were aromatherapy or placebo. Standard aromatherapy bottles were used for both the essential oils and the placebo, and all bottles were obscured with tape. Diffusion of the oils began around 9PM rounds and continued until the solution ran dry, about eight hours later. Patient doors were kept closed during the diffusion unless staff needed to enter or exit the room. The PSQI, ESASr, and FEA were then used to determine the effects of the essential oils on patients regarding insomnia, symptoms, and feelings toward aromatherapy.

Data Analysis

Data was analyzed using SPSS version 21.0. Descriptive statistics were used to evaluate the characteristics of the sample include gender, age, and scent selection on the PSQI and, ESASr.. T T-tests were then used to determine difference in PQSI, ESASr by gender on the scores for the week in which aromatherapy was given (either week 1 or week 3). One-way ANOVA tests were used to determine difference in PQSI, ESASr by age category and scent selection.

Chapter V

Results

A total of 50 subjects newly diagnosed patients with acute leukemia were enrolled in this study. The ages ranged from 19-72 years with 50% of the subjects between the ages of 41-60, and 56% of the subjects were male (Table 1). Out of the three options for aromatherapy scents, lavender was most commonly chosen by 58% of the people, followed by peppermint and chamomile.

Aim 1 To examine the differences in response to aromatherapy in patients with acute leukemia by gender on sleep quality and other common symptoms associated with cancer

Table 2 shows us a T-Test of the difference between males and females using the PSQI. Females' total sleep score (X=9.09) was lower than males' (X=10.18), indicating that they had reported slightly better sleep quality, although the difference was not statistically significant (p=.29). Within the subscales, subjects were least disturbed by Day Dysfunction Due To Sleepiness (X=.50 and X=.46). Both male (X=2.91) and female subjects (X=2.89) had the most difficulties with Sleep Efficiency (p=.84) Overall, there were no statistically significant differences in the subscales of the PSQI between males and females.

Tables 3 and 4 show the descriptive data and T-test results for the difference between genders using the ESASr. The mean score for all patients in regards to symptoms on the ESASr was 21.05. There is no statistically significant difference between males and females when looking at the various common symptoms as measured by the ESARr. Both genders responded similarly in each category. On

average, males and females reported that the aromatherapy helped relieve their shortness of breath most effectively (1.21) and their tiredness least effectively (3.82) compared to the other subcategories.

Aim 2: To examine the difference in response to aromatherapy in patients with acute leukemia by age on sleep quality and other common symptoms associated with cancer.

Table 5 shows us the breakdown of the different age groups, number of members in each group, and their average score on each subcategory of the PSQI. Out of each age group, the table shows that the sleep quality actually slightly increased with age. The mean total score for 19-40 year olds is 10.30 while the 61-72 year old group averaged 9.19 on the scale, being the best sleep out of the four groups. After completing the ANOVA test on this data (Table 6), we see that despite the slight differences in PSQI results, there is no significant difference in the response of the subjects by age category with respect to each of these difference subscales (p=.88).When looking at the difference between age groups in the ESASr, Table 7 and Table 8 show us the descriptive data and ANOVA test that was performed on the data. Unlike the PSQI results, the 19-40 year old group actually showed that the aromatherapy slightly helped alleviate symptoms better than any other age group (18.59), while the 61-72 year old age group reported a 21.21 out of 100. However, the data do not show any statistically significant difference between the different age groups in regards to the various subcategories. The tiredness category remains the category in which most people report the aromatherapy did

not benefit them as much (3.79), while it seemed to help alleviate shortness of breath (1.22) and depression (1.24) most effectively.

Aim 3: To determine if there are differences in responses to aromatherapy among acute leukemia by scent selection.

Table 9 shows how many times each of the scents have been chosen by patients and the mean score it received on the PSQI for each subcategory. Out of the three scents (lavender, peppermint, and chamomile), lavender was most commonly chosen with 29 people followed by peppermint and finally chamomile. After examining the descriptive date for all of the scents, chamomile reported the lowest score on the PSQI with a mean score of 7.57, indicating it resulted in the best sleep quality, while lavender had a mean score of 9.72 and peppermint had a mean score of 10.71. Again, in this table it shows that the subcategory Day Dysfunction due to Sleepiness had the lowest reported scores among the other subcategories with 0.48, indicating that all of the scents seemed to have some positive impact on their daytime function.

After running the ANOVA test on this data, the Day Dysfunction due to Sleepiness was the only subcategory that was statistically significant with a significance of 0.039 (Table 10). This shows that there is a significant difference when comparing the difference between all three of the scents individually.

Table 11 shows the descriptive information about the three different scents and the mean score they received after patients took the ESASr. After comparing the results, the lavender reported the lowest mean score of 19.33, indicating it helped alleviate the symptoms the best overall, while peppermint had the lowest mean

score on average at 23.00. Tiredness, again, ranked the lowest among the other subcategories with a score of 3.79. Coincidently, the subcategory Shortness of Breath reported a 1.22, and Depression reported a 1.24 like the PSQI results as well, implying that the aromatherapy again had the most beneficial impact on these categories. Another thing to note is the peppermint result in the Wellbeing subcategory. It reported as a 3.62, while the average was almost an entire point lower at 2.64. This shows that peppermint definitely did not benefit the patient in this category, and may have even made the patient's wellbeing worse during this time because of the significant difference between results.

After running the ANOVA test on the data, the Wellbeing category was the only one that was statistically significant with a significance of 0.027 (Table 12). This shows that the lavender scent had a more favorable impact than the other scents.

Chapter V

Discussion and Conclusion

The goal of the primary study was to determine the effects that aromatherapy had on a leukemia patient's sleep quality, symptom management, and overall wellbeing. After that initial experiment concluded, it is determined that the aromatherapy had a positive impact on patients undergoing chemotherapy in the hospital setting which adds to the growing body of evidence suggesting that aromatherapy is beneficial to hospitalized patients. This study, specifically, looked at the effects it had on gender, age, and scent preference. The results in Chapter IV suggest that there really is no statistical significance in regards to the difference in gender or age group. The lack of significant difference between the genders and age groups suggest that the aromatherapy benefits all subjects irrespective of gender or age. This is consistent with previous studies that have reported that aromatherapy interventions do not cause harm when recipients are screened properly (Hines, Steels, Chang & Gibbons, 2012; Hodge, McCarthy & Pierce, 2014; Varney & Buckle, 2013).

These results are encouraging and provide nurses and other with the opportunity to consider and explore the use of complimentary alternative therapies in their repertoire of comfort measures. Nurses can initiate aromatherapy without a medical order and it requires minimal training. This offers both nurses and patients the opportunity to consider non-pharmaceutical approaches for some of these symptoms. Additionally, nurses can teach oncology patients to use aromatherapy post-discharge.

Aromatherapy therapy companies manufacture many different scents. Therefore, patients have options based on personal preference. Our results suggest that with the exception of daytime sleepiness there were no differences in responses due to scent. This suggests that patients should select the scent that they enjoy the most.

There are several limitations to this study. Most prominently, this study was performed in one hospital, on one specific acute leukemia unit, and with one patient population. For future studies, there should be a larger sample size with a variety of people, and it should be tested in multiple clinical arenas aromatherapy affects most patients equally.

In conclusion, aromatherapy has been shown to benefit patients in other studies. However, our study as a randomized control trial further strengthens the evidence for this therapy. It has proven to benefit males and females of varying age groups equally, and subjects should be encouraged to select their scent of preference.

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Table 1:
Subject Demographic Information Results

Sex (m=male, f=female)

	Frequency	Percent	Valid Percent	Cumulative Percent
F	22	44.0	44.0	44.0
M	28	56.0	56.0	100.0
Total	50	100.0	100.0	

Chosen Scent

	Frequency	Percent	Valid Percent	Cumulative Percent
Chamomile	7	14.0	14.0	14.0
Lavender	29	58.0	58.0	72.0
Peppermint	14	28.0	28.0	100.0
Total	50	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation
Age	50	19	72	51.70	13.453
Valid N (listwise)	50				

Table 2:
PSQI and Gender

	Gender	Mean	Statistical t test Significance	Degrees of Freedom	Significance (2-tailed)
Duration of Sleep	F	1.09	.650	48	.312
	M	1.43			
Sleep Latency	F	.95	.816	48	.388
	M	1.18			
Day Dysfunction Due To Sleepiness	F	.50	.799	48	.841
	M	.46			
Sleep Efficiency	F	2.91	.813	48	.893
	M	2.89			
Overall Sleep Quality	F	1.23	.926	47	.229
	M	1.52			
Need Meds To Sleep	F	1.09	.358	47	.636
	M	1.26			
Total	F	9.09	.270	48	.294
	M	10.18			

Table 3:
ESASr and Gender Descriptives

	Gender	N	Mean	Standard Deviation
Total	F	21	21.99	10.717
	M	27	20.11	12.511
Pain	F	21	2.22	1.692
	M	27	2.63	2.353
Tiredness	F	21	4.06	1.439
	M	27	3.58	1.958
Drowsiness	F	21	3.31	1.707
	M	27	2.73	1.939
Nausea	F	21	1.83	2.259
	M	27	1.47	1.670
Lack of Appetite	F	21	3.82	2.582
	M	27	3.56	2.676
Shortness of Breath	F	21	1.18	1.551
	M	27	1.24	1.679
Depression	F	21	1.24	1.568
	M	27	1.24	1.693
Anxiety	F	21	1.46	1.464
	M	27	1.49	1.976
Wellbeing	F	21	2.72	1.591
	M	27	2.58	1.985

Table 4:
ESASr and Gender

	Levene's Test for Equality of Variances		T-Test for Equality of Means			
	F	**Sig**	**t**	**df**	**Sig (2-tailed)**	**Mean Difference**
Total	.901	.347	.550	46	.585	1.882
Pain	2.118	.152	-.661	46	.512	-.402
Tiredness	3.184	.081	.947	46	.348	.483
Drowsiness	2.465	.123	1.083	46	.284	.580
Nausea	1.418	.240	.633	46	.530	.359
Lack of Appetite	.094	.761	.339	46	.736	.260
Shortness of Breath	.464	.499	-.127	46	.900	-.060
Depression	.002	.963	.008	46	.994	.004
Anxiety	.798	.376	-.045	46	.965	-.023
Wellbeing	2.813	.100	.276	46	.784	.147

Table 5:
PSQI and Age Descriptives

		N	Mean	Standard Deviation
Duration of Sleep	19-40	10	1.30	1.25
	41-50	12	1.25	1.22
	51-60	12	1.25	1.14
	61-72	16	1.31	1.20
	Total	50	1.28	1.16
Sleep Latency	19-40	10	1.30	1.25
	41-50	12	1.17	.84
	51-60	12	1.00	.74
	61-72	16	.94	.85
	Total	50	1.08	.90
Day Dysfunction	19-40	10	.60	.52
Due To Sleepiness	41-50	12	.58	.67
	51-60	12	.58	.67
	61-72	16	.25	.58
	Total	50	.48	.61
Sleep Efficiency	19-40	10	3.00	.00
	41-50	12	2.83	.58
	51-60	12	2.75	.62
	61-72	16	3.00	.00
	Total	50	2.90	.42
Overall Sleep Quality	19-40	10	1.30	.82
	41-50	12	1.67	.99
	51-60	11	1.36	.81
	61-72	16	1.25	.78
	Total	49	1.39	.84
Need Meds To Sleep	19-40	10	1.50	1.18
	41-50	12	1.08	1.24
	51-60	11	1.09	1.14
	61-72	16	1.13	1.36
	Total	49	1.18	1.22
Total	19-40	10	10.30	4.24
	41-50	12	10.00	3.36
	51-60	12	9.58	3.52
	61-72	16	9.19	3.69
	Total	50	9.70	3.60

Table 6:
PSQI and Age

		Sum of Squares	df	Mean Square	F	Sig.
Duration of Sleep	Between Groups	.043	3	.014	.010	.999
	Within Groups	66.038	46	1.436		
	Total	66.080	49			
Sleep Latency	Between Groups	.976	3	.325	.387	.763
	Within Groups	38.704	46	.841		
	Total	39.680	49			
Day Dysfunction due to Sleepiness	Between Groups	1.247	3	.416	1.109	.355
	Within Groups	17.233	46	.375		
	Total	18.480	49			
Sleep Efficiency	Between Groups	.583	3	.194	1.130	.347
	Within Groups	7.917	46	.172		
	Total	8.500	49			
Overall Sleep Quality	Between Groups	1.321	3	.440	.613	.610
	Within Groups	32.312	45	.718		
	Total	33.633	48			
Need Meds to Sleep	Between Groups	1.271	3	.424	.272	.845
	Within Groups	70.076	45	1.557		
	Total	71.347	48			
Total	Between Groups	9.046	3	3.015	.221	.881
	Within Groups	627.454	46	13.640		
	Total	636.500	49			

Table 7:
ESASr and Age Descriptives

		N	Mean	Standard Deviation
Total	19-40	10	18.59	8.812
	41-50	11	19.66	12.526
	51-60	12	23.71	12.736
	61-72	15	21.21	12.505
	Total	48	20.93	11.677
Pain	19-40	10	2.80	1.307
	41-50	11	2.09	2.311
	51-60	12	3.29	2.744
	61-72	15	1.81	1.569
	Total	48	2.45	2.079
Tiredness	19-40	10	3.53	1.171
	41-50	11	3.62	1.882
	51-60	12	4.13	1.521
	61-72	15	3.81	2.207
	Total	48	3.79	1.749
Drowsiness	19-40	10	2.94	1.644
	41-50	11	2.85	1.900
	51-60	12	3.25	1.776
	61-72	15	2.88	2.132
	Total	48	2.98	1.845
Nausea	19-40	10	1.29	1.641
	41-50	11	1.57	1.916
	51-60	12	1.74	1.714
	61-72	15	1.81	2.405
	Total	48	1.63	1.936
Lack of Appetite	19-40	10	3.00	2.539
	41-50	11	3.65	2.964
	51-60	12	3.08	2.718
	61-72	15	4.60	2.261
	Total	48	3.67	2.611
Shortness of Breath	19-40	10	1.39	1.662
	41-50	11	.82	1.510
	51-60	12	1.05	1.140
	61-72	15	1.53	1.994
	Total	48	1.22	1.608

Depression	19-40	10	.53	.876
	41-50	11	.99	1.923
	51-60	12	1.93	1.750
	61-72	15	1.36	1.569
	Total	48	1.24	1.622
Anxiety	19-40	10	.81	.878
	41-50	11	1.06	1.733
	51-60	12	2.31	2.291
	61-72	15	1.55	1.583
	Total	48	1.48	1.753
Wellbeing	19-40	10	2.30	1.983
	41-50	11	3.04	1.963
	51-60	12	2.74	1.381
	61-72	15	2.50	1.984
	Total	48	2.64	1.806

Table 8:
ESASr and Age

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Total	Between Groups	166.820	3	55.607	.392	.759
	Within Groups	6241.505	44	141.852		
	Total	6408.325	47			
Pain	Between Groups	17.075	3	5.692	1.346	.272
	Within Groups	186.057	44	4.229		
	Total	203.132	47			
Tiredness	Between Groups	2.437	3	.812	.253	.859
	Within Groups	141.403	44	3.214		
	Total	143.840	47			
Drowsiness	Between Groups	1.219	3	.406	.113	.952
	Within Groups	158.772	44	3.608		
	Total	159.992	47			
Nausea	Between Groups	1.847	3	.616	.155	.926
	Within Groups	174.231	44	3.960		
	Total	176.078	47			
Lack of Appetite	Between Groups	21.652	3	7.217	1.063	.374
	Within Groups	298.684	44	6.788		
	Total	320.336	47			

Shortness of Breath	Between Groups	3.876	3	1.292	.483	.697
	Within Groups	117.602	44	2.673		
	Total	121.478	47			
Depression	Between Groups	11.659	3	3.886	1.526	.221
	Within Groups	112.029	44	2.546		
	Total	123.688	47			
Anxiety	Between Groups	14.664	3	4.888	1.657	.190
	Within Groups	129.788	44	2.950		
	Total	144.451	47			
Wellbeing	Between Groups	3.310	3	1.103	.324	.808
	Within Groups	150.015	44	3.409		
	Total	153.325	47			

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Table 9:
PSQI and Scent Descriptives

	Scent	N	Mean	Standard Deviation
Duration of Sleep	C	7	.57	.535
	L	29	1.31	1.257
	P	14	1.57	1.089
	Total	50	1.28	1.161
Sleep Latency	C	7	.57	.535
	L	29	1.17	.966
	P	14	1.14	.864
	Total	50	1.08	.900
Day Dysfunction due to Sleepiness	C	7	.00	.000
	L	29	.48	.574
	P	14	.71	.726
	Total	50	.48	.614
Sleep Efficiency	C	7	3.00	.000
	L	29	2.86	.516
	P	14	2.93	.267
	Total	50	2.90	.416
Overall Sleep Quality	C	7	1.00	.577
	L	29	1.31	.850
	P	13	1.77	.832
	Total	49	1.39	.837

	C	7	1.14	1.464
Need Meds to	L	29	1.24	1.185
Sleep	P	13	1.08	1.256
	Total	49	1.18	1.219
	C	7	7.57	1.397
Total	L	29	9.72	3.683
	P	14	10.71	3.911
	Total	50	9.70	3.604

Table 10:
PSQI and Scent

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Duration of	Between Groups	4.730	2	2.365	1.812	.175
Sleep	Within Groups	61.350	47	1.305		
	Total	66.080	49			
Sleep	Between Groups	2.113	2	1.057	1.322	.276
Latency	Within Groups	37.567	47	.799		
	Total	39.680	49			
Day Dysfunction	Between Groups	2.381	2	1.191	3.476	.039
due to	Within Groups	16.099	47	.343		
Sleepiness	Total	18.480	49			
Sleep	Between Groups	.123	2	.062	.345	.710
Efficiency	Within Groups	8.377	47	.178		
	Total	8.500	49			
Overall	Between Groups	3.118	2	1.559	2.350	.107
Sleep	Within Groups	30.515	46	.663		
Quality	Total	33.633	48			
Need Meds	Between Groups	.256	2	.128	.083	.921
to Sleep	Within Groups	71.091	46	1.545		
	Total	71.347	48			
Total	Between Groups	46.135	2	23.068	1.836	.171
	Within Groups	590.365	47	12.561		
	Total	636.500	49			

Table 11:
ESASr and Scent Descriptives

		N	Mean	Standard Deviation
Total	C	7	22.98	14.238
	L	27	19.33	12.293
	P	14	23.00	9.217
	Total	48	20.93	11.677
Pain	C	7	1.91	1.858
	L	27	2.67	2.373
	P	14	2.30	1.580
	Total	48	2.45	2.079
Tiredness	C	7	3.26	1.273
	L	27	3.68	1.906
	P	14	4.27	1.619
	Total	48	3.79	1.749
Drowsiness	C	7	3.08	1.433
	L	27	2.92	1.934
	P	14	3.04	1.965
	Total	48	2.98	1.845
Nausea	C	7	2.43	2.167
	L	27	1.38	2.013
	P	14	1.71	1.669
	Total	48	1.63	1.936
Lack of Appetite	C	7	3.98	2.501
	L	27	2.94	2.461
	P	14	4.92	2.608
	Total	48	3.67	2.611
Shortness of Breath	C	7	1.35	1.726
	L	27	1.06	1.517
	P	14	1.46	1.800
	Total	48	1.22	1.608
Depression	C	7	1.78	1.861
	L	27	1.22	1.814
	P	14	1.02	1.061
	Total	48	1.24	1.622
Anxiety	C	7	2.00	2.024
	L	27	1.38	1.802
	P	14	1.41	1.598
	Total	48	1.48	1.753

Wellbeing	C	7	2.88	1.830
	L	27	2.07	1.636
	P	14	3.62	1.775
	Total	48	2.64	1.806

Table 12:
ESASr and Scent

		Sum of Squares	df	Mean Square	F	Sig.
Total	Between Groups	158.212	2	79.106	.570	.570
	Within Groups	6250.113	45	138.891		
	Total	6408.325	47			
Pain	Between Groups	3.599	2	1.799	.406	.669
	Within Groups	199.533	45	4.434		
	Total	203.132	47			
Tiredness	Between Groups	5.542	2	2.771	.902	.413
	Within Groups	138.298	45	3.073		
	Total	143.840	47			
Drowsiness	Between Groups	.211	2	.105	.030	.971
	Within Groups	159.781	45	3.551		
	Total	159.992	47			
Nausea	Between Groups	6.309	2	3.155	.836	.440
	Within Groups	169.769	45	3.773		
	Total	176.078	47			
Lack of Appetite	Between Groups	36.872	2	18.436	2.927	.064
	Within Groups	283.464	45	6.299		
	Total	320.336	47			
Shortness of Breath	Between Groups	1.619	2	.809	.304	.739
	Within Groups	119.859	45	2.664		
	Total	121.478	47			
Depression	Between Groups	2.717	2	1.359	.505	.607
	Within Groups	120.971	45	2.688		
	Total	123.688	47			
Anxiety	Between Groups	2.263	2	1.131	.358	.701
	Within Groups	142.188	45	3.160		
	Total	144.451	47			
Wellbeing	Between Groups	22.693	2	11.347	3.909	.027
	Within Groups	130.632	45	2.903		
	Total	153.325	47			